



A.D. 1866, *27th MARCH.* N^o 898.

S P E C I F I C A T I O N

OF

CHARLES THIEME LIERNUR.

COLLECTING SEWAGE, &c.

L O N D O N :

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A.D. 1866, 27th MARCH. N° 898.

Collecting Sewage, &c.

LETTERS PATENT to Charles Thieme Liernur, Engineer, of the Firm of Liernur, Krepp, and Company, American Engineers, of Frankfort-on-the-Maine, for the Invention of “A PNEUMATIC METHOD FOR THE INOFFENSIVE REMOVAL OF ALL FLUIDS, SOLIDS, AND GASES FROM WATERCLOSETS OR PRIVIES AND THEIR CONDUITS, AND OF STORING SAID MATERIALS SO THAT THEY MAY BE APPLIED IN THEIR NATURAL UNCHANGED FORM TO AGRICULTURE AND OTHER BRANCHES OF INDUSTRY.”

Sealed the 25th September 1866, and dated the 27th March 1866.

PROVISIONAL SPECIFICATION left by the said Charles Thieme Liernur at the Office of the Commissioners of Patents, with his Petition, on the 27th March 1866.

I, CHARLES THIEME LIERNUR, Engineer, of the Firm of Liernur, Krepp,
5 and Company, American Engineers, of Frankfort-on-the-Maine, do hereby declare the nature of the said Invention for “A PNEUMATIC METHOD FOR THE INOFFENSIVE REMOVAL OF ALL FLUIDS, SOLIDS, AND GASES FROM WATERCLOSETS OR PRIVIES AND THEIR CONDUITS, AND OF STORING SAID MATERIALS SO THAT THEY MAY BE APPLIED IN THEIR NATURAL UNCHANGED FORM TO AGRICULTURE AND OTHER
10 BRANCHES OF INDUSTRY,” to be as follows:—

This Invention relates to a new method of collecting the sewage of towns and removing all offensive gases from waterclosets, in order to utilize such sewage matter for manure or other purposes.

I propose to place a reservoir of iron or other material underneath the

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pavement, by preference at the intersection of streets or otherwise where access can be had by carts. A main drainage pipe is connected to the top or roof of the reservoir, and the pipes from the adjacent houses are brought into this main pipe. A slide valve is placed in the main pipe just above its junction with the reservoir in order to open or close the communication. The stem of the valve passes through a stuffing box into an outer casing on the top of the reservoir. The slide valve forms an air-tight shut-off when closed. Within the outer casing an air pipe is fixed communicating with the top of the reservoir; there is also a large tube descending vertically into the reservoir, the upper part of this tube being also contained within the outer casing. This large tube may be termed the manure tube; it descends to within a few inches of the bottom of the reservoir. There is a lid on the top of the casing; this lid forms a surface level with the roadway and closes the casing and pipes. The air pipe is provided with a cock opening and closing at right angles. A handle or crank is connected to the cock and to the slide valve of the main pipe in order that when the cock is shut the slide is opened, and vice versa. In order to withdraw the contents of the waterclosets adjacent to the reservoir a cart or waggon is brought over the opened lid of the reservoir, and the tube of an air pump is connected to the air pipe, and the air is exhausted from the reservoir until a more or less perfect vacuum is created; the cock of the air pipe is then to be shut and the slide valve of the main tube opened as before mentioned; this will cause a rush of the contents of the closets and pipes communicating with the main, and the pressure of the air will force the sewage fluids and gases into the reservoir, thus supplying the closets and pipes with a fresh supply of atmospheric air and flushing the pipes completely. Slide valves are to be applied to each separate pipe from the closets in cases where such closets are at a considerable distance from the reservoir. With regard to such closets the slide valve on the reservoir could then be dispensed with. The cock of each closet pipe is to be reached from the open street at a point near the curbstone or edge of the side walk. The process of emptying these pipes after the air is pumped out of the reservoir is simply to open and shut these pipes one after the other, when their contents will rush into the reservoir by the force or pressure of the air. The emptying of the reservoir is then to be effected by pumping or by withdrawal into a vacuum in a vessel on the cart or waggon. A small steam engine is attached to the cart to drive an air pump. All the gases withdrawn from the reservoir are forced or injected into the small coke furnace, thus creating a blast whereby the gases are burned and destroyed.

The burning of these offensive gases has hitherto been applied only to

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stationary machines, whereas by this Invention the blast is arranged in a moveable waggon. Human excrement in its natural state is far more valuable for agricultural and other purposes than if it is charged by admixture of deodorizing chemicals or diluted with water. It is therefore one of the
5 chief objects of this Invention to collect and retain as far as possible human excrements in their natural state. These sewage matters are then to be stored in wooden barrels of any convenient size and shape made perfectly water-tight and air-tight. Into these barrels the sewage matters are to be transferred from the pneumatic waggons by the pneumatic process, in order
10 that they may be conveyed to any distance required for application to agricultural or other purposes without the possibility of emitting any noxious effluvia. Open vessels and casks have hitherto been employed for the collection of sewage matters, but the use of strong air-tight and water-tight barrels, capable of being moved about and rolled when filled, is an improvement on the former
15 method.

In order to apply the sewage matter to agriculture I provide the plough with a barrel of sewage, the barrel being attached or held on the plough by iron brackets or supports and clamps. A pipe is brought into communication with the barrel, and the exit of the pipe is brought just behind the plough-
20 share. The pipe is furnished with a valve or cock, in order to regulate the flow of the manure, which consequently falls into the furrow. Behind this pipe two blades are applied connected to the frame of the plough; these blades throw the earth into the furrow and so cover the manure with soil immediately it has fallen into the furrow, whereby the manure is completely
25 absorbed by the loose soil of the furrow and no offensive effluvium can occur.

SPECIFICATION in pursuance of the conditions of the Letters Patent, filed by the said Charles Thieme Liernur in the Great Seal Patent Office on the 27th September 1866.

30 **TO ALL TO WHOM THESE PRESENTS SHALL COME, I, CHARLES THIEME LIERNUR, Engineer, of the Firm of Liernur, Krepp, and Company, American Engineers, of Frankfort-on-the-Maine, send greeting.**

WHEREAS Her most Excellent Majesty Queen Victoria, by Her Letters Patent, bearing date the Twenty-seventh day of March, in the year of our
35 Lord One thousand eight hundred and sixty-six, in the twenty-ninth year of Her reign, did, for Herself, Her heirs and successors, give and grant unto me,

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the said Charles Thieme Liernur, Her special licence that I, the said Charles Thieme Liernur, my executors, administrators, and assigns, or such others as I, the said Charles Thieme Liernur, my executors, administrators, and assigns, should at any time agree with, and no others, from time to time and at all times thereafter during the term therein expressed, should and lawfully might make, use, exercise, and vend, within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an Invention for "A PNEUMATIC METHOD FOR THE INOFFENSIVE REMOVAL OF ALL FLUIDS, SOLIDS, AND GASES FROM WATERCLOSETS OR PRIVIES AND THEIR CONDUITS, AND OF STORING SAID MATERIALS SO THAT THEY MAY BE APPLIED IN THEIR NATURAL UNCHANGED FORM TO AGRICULTURE AND OTHER BRANCHES OF INDUSTRY," upon the condition (amongst others) that I, the said Charles Thieme Liernur, my executors or administrators, by an instrument in writing under my, or their, or one of their hands and seals, should particularly describe and ascertain the nature of the said Invention, and in what manner the same was to be performed, and cause the same to be filed in the Great Seal Patent Office within six calendar months next and immediately after the date of the said Letters Patent.

NOW KNOW YE, that I, the said Charles Thieme Liernur, do hereby declare the nature of my said Invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

The object and nature of this Invention is as follows:—To empty and thoroughly clean privies and their pipes daily, or whenever required, by atmospheric pressure, removing all solids, fluids, and gases contained therein, and supplying them instead with fresh air; to accomplish the above object without offense to the inhabitants; to collect, store, and transport the excrements in an inoffensive manner; to apply the excrements to lands as a fertiliser in such a manner that direct contact with the seeds is prevented, and that all useful latent gases are solved and absorbed by the soil without contamination of the surrounding atmosphere. These four points are the constituent elements of but one single comprehensive design, namely, to render human excrements useful instead of dangerous, and hence any one of these points would be ineffectual and worthless without the others. Nothing, for instance, is accomplished by removing excrements merely to cast them into rivers or harbors, or to spread them over lands where they just as before poison the air, which is carried back by every gust of wind among habitations of men, there causing pestilence and death. It certainly is not enough to take these excrements away from one place to make them dan-

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gerous in another, on the contrary, their deadly effects must be rendered harmless to animal and vegetable life once and for ever. Happily a due observance of the laws of nature teaches us how such excrements may become a blessing if properly applied, and this system is based upon such observance.

5 Secondly, general description of sewerage system (see Plate No. 1 of accompanying Drawings, which shews the general arrangement as applied to part of a city.—An iron reservoir is placed under the pavement of all the street crossings. All the surrounding privies empty by means of pipes in this reservoir in such a manner that no offensive gases can escape. The pipes are
10 provided with valves, which can be worked from the side walks, so that the communication between the privies and the reservoir can be established at will. Once in 24 hours, or whenever the process is deemed necessary, and while the valves are shut, the air is pumped out of the reservoirs and pipes. The cleaning process consists then simply in opening and closing again imme-
15 diately those valves one after the other, by means of which the whole contents of the privies including the gases will be discharged at once into the subterranean reservoir with the force of an atmospheric pressure, equal in its mechanical effect to the rushing through of a column of water from 25 to 30 feet high. The urinal discharges being eight parts to one in proportion
20 to solids afford moisture enough to prevent drying and caking of the solid excrements, and to keep them in a sufficient liquid state to admit of easy removal, so that the privies will be left every day totally clean and supplied with fresh air. The reservoirs are then emptied by a similar inodorous pneumatic process, and their contents removed with waggons. By this
25 method, which is cheaper and far more effective than any other system, the natural condition of human excrements is maintained, their transportation practicable, and their value for agriculture immeasurably increased, being undeteriorated by admixture of deodorizing chemicals or dilution by water. Another great advantage is, that thus the privy contents are removed as fast
30 as they are produced, which is daily, instead of being retained for months or years in brick cesspools, which through their porousness allow filtration, and owing to their limited capacity speedily overflow, thus saturating the soil with noxious liquids and poisoning the neighbouring wells.

Thirdly, detailed description of sewerage system, see Sheet 2, Figs. 1 and 2,
35 which shew plan and section of iron reservoir.—This reservoir is composed of boiler plate, and made strong enough to resist atmospheric pressure. Its size is a matter of calculation, depending upon the number of privies which empty into it. In its spherical top there are openings for the connection of the main sewage pipes. There are also two vertical pipes, the larger one, the dung

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pipe, reaching nearly to the bottom, is used for emptying the reservoir by means of a pneumatic waggon; the smaller one, piercing only the top, serves for pumping out the air. Both pipes are enclosed in a casing, covered with a lid, lying on a level with the street pavement. Figs. 3 and 4 shew plan and section of the valves placed on the branch pipes connecting the privies with the main pipes near the edge of the trottoirs. These valves are opened and closed by applying a lever to an underground socket.

Fourthly, a central valve placed on the reservoir may be used instead of the various branch pipe valves in case the reservoir can be placed at about an equal distance from all the privies emptying into it, as, for instance, in courts or squares.

Fifthly, mode of connecting privies with a vertical privy pipe prolonged to the roof for purposes of ventilation is shewn by Fig. 5. The lower part of this vertical pipe has a bend for the collection of the excrements falling during the day from the privy funnels of the various floors. The vertical pipe is best made of brown stoneware glazed inside; the curved portion leading to the trottoir valve should be made of cast iron, and the privy funnels of glazed white stoneware; the latter, shewn more in detail by Fig. 6, now take the place of the so-called waterclosets, they are constructed so as to compel a speedy fall of the human discharges, and to prevent matter dropped from a funnel above to find a resting place on a lower one. There being no valve to the funnel outlet to bar the passage nothing is seen at any time but a clean short white tube with a dark space beyond, instead of the disgusting sight of a mass of excrements and soiled paper, so often presented in watercloset basins with valves or water traps. The droppings from the funnels above falling in the bend below, pounded together in a homogeneous mass, form there a sort of prop or piston, upon which the atmospheric pressure admitted by the ventilator in the roof acts with a force of 280 to 300 pounds for a 7-inch pipe whenever the trottoir valve is suddenly opened. The paper used is now a useful and important ingredient for sweeping and cleaning, as it gives to the mass a tenacity and compactness which it otherwise would not have. Cloths, old rags, and all such materials often thrown into privies also assist the pneumatic process instead of causing stoppages, nor can even old shoes or stones be any impediment to the mighty force in operation. As the outlet of the privy funnel where it joins the vertical pipe is made smaller than the curved portion of the lower pipe or any other part of it, and is smaller than the trottoir valve opening, it follows that whatever passes through the privy funnel will surely find its way into the street reservoir.

Sixthly, a small steam engine attached to the pneumatic waggon drives an

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air pump without emitting smoke or sparks, the fuel being common gas coke. All the air pumped out of the subterranean and waggon reservoirs is immediately injected into the furnace of the steam boiler, said air containing oxygen enough to give a good blast for feeding the flame and burning all noxious
5 gases, so that the whole process does not molest even passers-by.

Seventhly, the human excrements thus collected in the pneumatic waggon reservoir in their natural condition undeteriorated by chemicals or dilution by water are now ready for storage or transport, which may be effected in different ways, depending on the topographical position of the town and the
10 nature of the lands within its vicinity.

Eighthly, large covered magazines constructed of masonry will be found useful in many cases. These buildings are to be entirely closed and ventilated by a chimney in which any escaping gases are burned. The wagons drive inside such buildings, and there decant their contents by direct pressure into
15 barrels, as hereafter stated in paragraph ten.

Ninthly, air-tight iron boats for the pneumatic waggons to empty their contents in may be employed in case a city is situated on a navigable stream leading to lands adapted to culture by human manure. Such boats form then at once an excellent means of conveyance.

20 Tenthly, air and water tight wooden barrels, strong enough to bear any handling when filled, are generally the cheapest and most convenient means of transporting human manure collected by the pneumatic system herewith elucidated. Such barrels when filled by pneumatic process may be forwarded by rail, steamboat, or any other conveyance to any distance required in a
25 perfectly inoffensive manner.

Eleventhly, subsoil application of human excrements as manure on arable land is effected by placing the above barrels on ploughs, see Sheet 3, Fig. 1. A pipe is fastened to the barrels by a stout leather breeching and two broad straps. The barrel discharges the manure at once into the furrow made by
30 the ploughshare, and two scrapers level again the ridges of the cast-up earth, thus closing the furrow. The pipe has a small valve which regulates the discharge.

Twelfthly, the advantages of manuring by the present system are twofold, viz., while the ploughshare breaks up and turns over the earth for sowing
35 or planting, the manure is deposited in the furrow behind, and does not come therefor into immediate contact with the soil receiving the seed, but is left gradually to impart its fertilizing ingredients to the loose soil, partly by absorption and partly by solution of the latent gases. This most important

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process is assisted and promoted by the closing of the furrow immediately afterwards, whereby evaporation is prevented. The result is that when this system is applied the second season, the soil when turned over by the ploughshare is found manured for the coming crop without there being any danger to its vigorous and healthy growth by the direct contact of the seed with fresh human manure, which contact experience has shewn must be carefully avoided. Next the solution and absorption of all offensive gases by the loose soil covering the human manure immediately after its deposit prevents evaporation and consequently contamination of the atmosphere.

Thirteenthly, the mode of manuring meadow land is shewn in Fig. 2 of Sheet 3. Instead of a ploughshare a knife is used standing upon a broad hollow foot, a hole passes through both and conducts the excrements running out of the barrel pipe into the opening made by the incision of the knife and its foot, depositing said excrements at such depths below the sods as the farmers may deem necessary to prevent contact with their roots. The sods close themselves immediately afterwards again, and prevent thereby escape of useful gases. In this manner meadows can be manured constantly and cattle even continue their grazing; the chief aim and merit is the prevention of cattle diseases resulting from food, et cetera, contaminated with manure. In case the sods or their roots are so tough that the passage of the ploughing knife would tear or dislocate them, a small forerunning knife (not shewn in the Drawing to avoid complication) is placed in front of the main knife, moving up and down vertically about 3 inches. Its lower end slides through a hole in the foot, and its upper end is hung on a $1\frac{1}{2}$ -inch crank of a small axle, which receives its motion by means of an endless chain from one of the rear wheel hubs.

Fourteenthly, when the lands are frozen or so covered with snow that ploughing is impracticable the manure barrels are to be kept in winter sheds, these being covered buildings, when by heating the air or admittance of cold the contents of said barrels can be kept at freezing point, that is to say, that they neither ferment by heating nor freeze, and thereby lose their agricultural value. In all other weather, that is to say, when it is not freezing, the object is to convey each day the excrements produced during the last 24 hours immediately to the country and store them in the soil for gradual decomposition and absorption by means of manure ploughs described above.

Having now described my said Invention, and the manner in which the same is to be performed, I claim,—

The instantaneous daily inodorous emptying of privies and their pipes by

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suddenly opening slide or other valves, which place them in connection with street reservoirs out of which the air has been pumped, and employing the apparatus substantially as described.

Employing a pneumatic waggon having attached to its reservoir a steam
5 engine driving an air pump for the purpose of exhausting the air from the conduits and subterranean reservoirs, which communicate with the surrounding privies, in order that said privies and their conduits may be cleaned and emptied whenever desired by atmospheric pressure, and their contents transferred to the reservoir of said pneumatic waggon, the whole moveable
10 apparatus so arranged that the foul air pumped out of such reservoirs, et cetera, shall be passed through the fire of the steam engine furnace in order thus to purify it substantially as described.

The inodorous collection, storage, and transport of unchanged and undiluted human excrements in air and water tight portable barrels for application to
15 agricultural and other industrial purposes substantially as described.

Placing barrels containing manure on ploughs for the purpose of discharging the contents of said barrels into the furrows made by the ploughshare, and closing said furrows again immediately afterwards by scrapers, the whole contrivance to be adapted to the particular construction of the ploughs substantially
20 as described.

The mode of manuring meadow land and preserving the manure substantially as last described.

In witness whereof, I, the said Charles Thieme Liernur, have hereunto set my hand and seal, this Nineteenth day of September, in the year of
25 our Lord One thousand eight hundred and sixty-six.

CHARLES THIEME LIERNUR. (L.S.)

Witness,

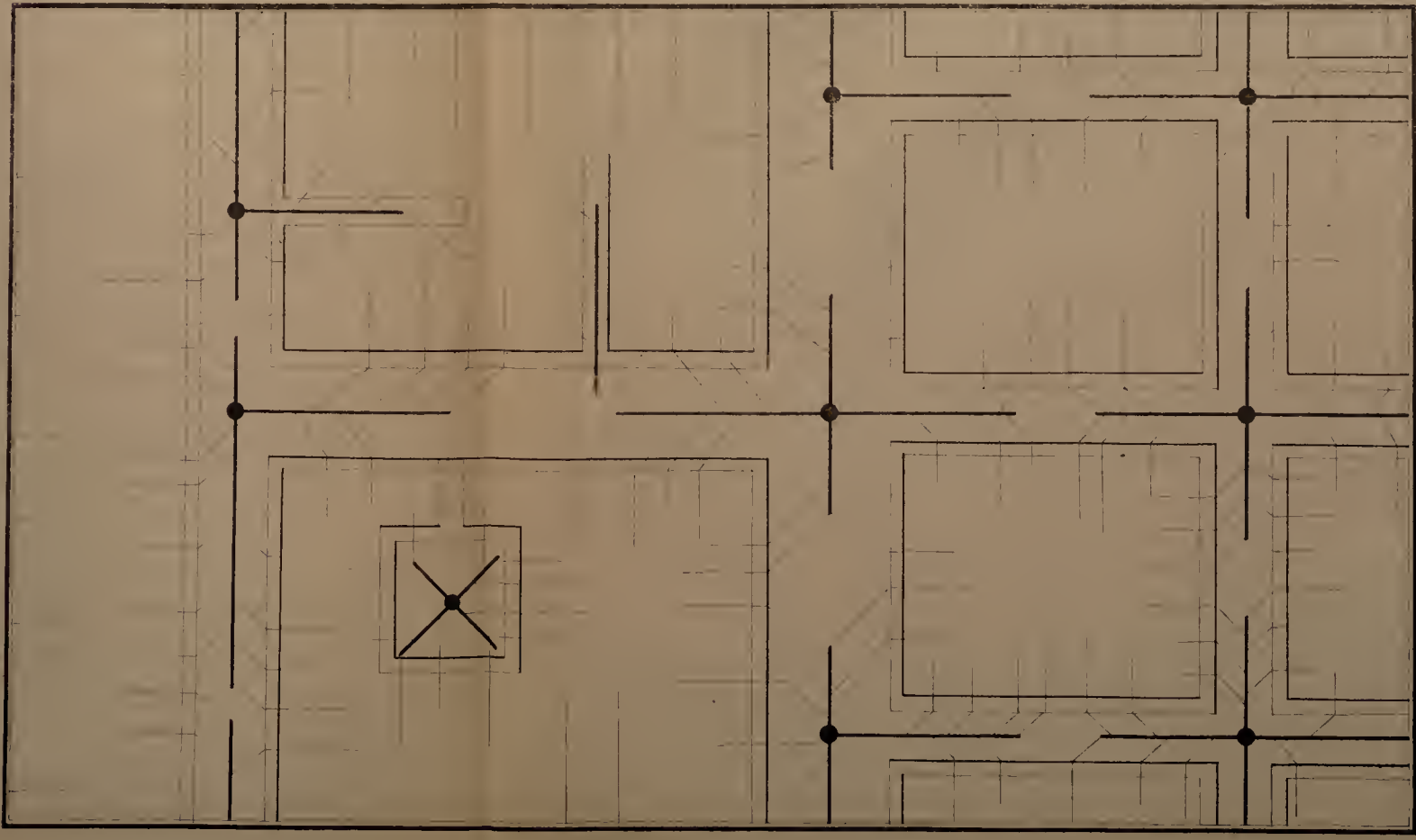
W. DE VISSER,

Haarlem, Holland.

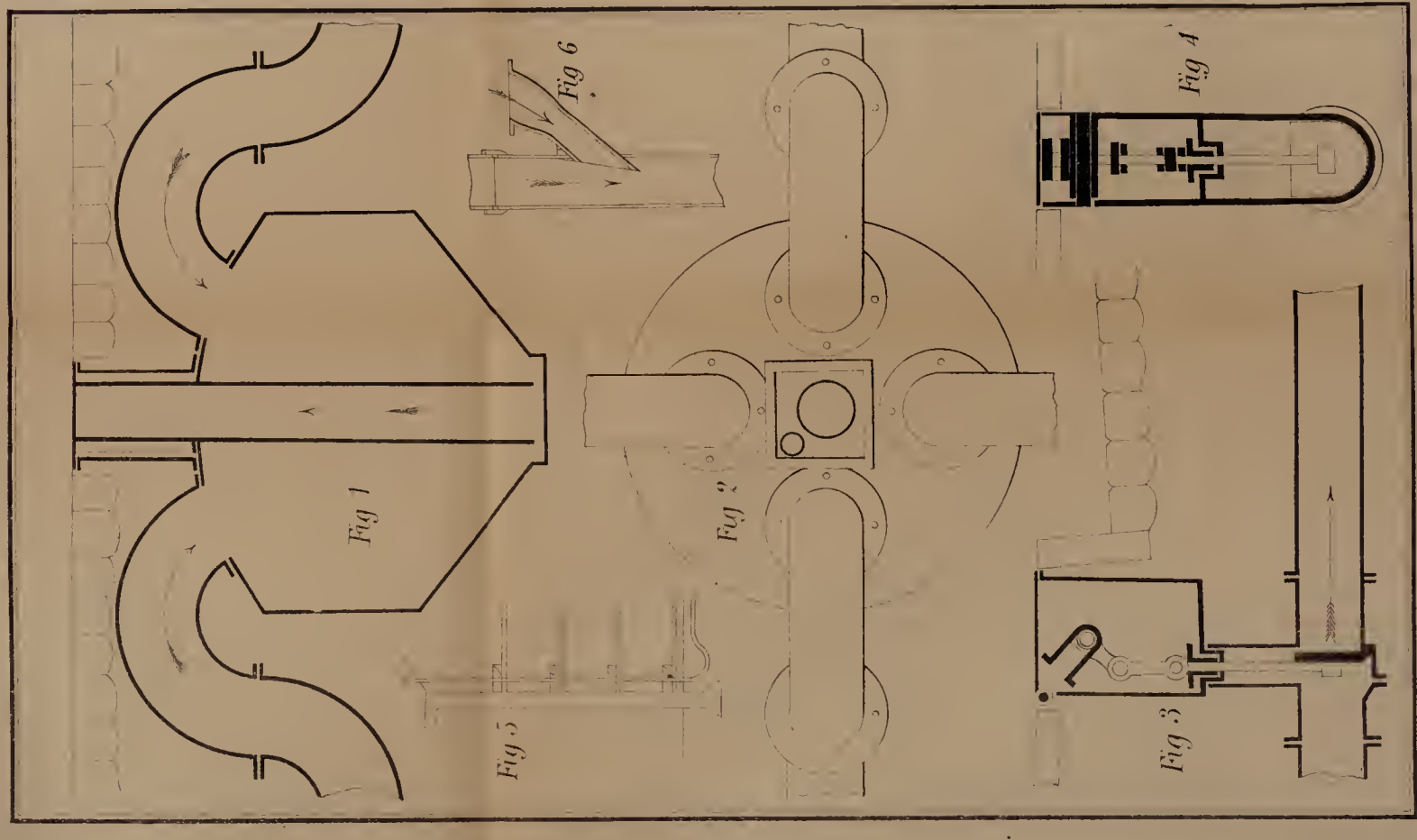
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Plate of Sheet 1.



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